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ABSTRACT

Thirty-six students enrolled in an elementary science methods course were randomly selected and given an instrument using Osgood's semantic differential approach the first week of class, the sixth week on campus prior to field experiences, and the thirteenth week following field experiences. The elementary teachers who had observed the university students teaching in their classrooms were given the semantic differential prior to the students teaching and following the students teaching in their classrooms. Five protocols were used to test the change in attitudes: (1) Science in High School; (2) Science as Remembered in Elementary School; (3) Science Methods Course; (4) Science in the News; and (5) Teaching Science to Children. At the end of five weeks of on-campus activities, the university students changed their attitudes in a negative direction toward (1) and (2), but in a positive direction toward (3) and (5). Following the reality experiences with children in the field, attitudes toward (3) and (5) were even more positive than prior to field experiences. The attitudes of classroom teachers who had university students teach science activities in their classrooms also changed in a negative direction toward (1) and in a positive direction toward (5). (Author/MH)

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THE INVESTIGATION OF ATTITUDE CHANGES OF ELEMENTARY PRESERVICE TEACHERS IN A COMPETENCY-BASED, FIELD-ORIENTED SCIENCE METHODS COURSE AND ATTITUDE CHANGES OF CLASSROOM TEACHERS COOPERATING WITH THE FIELD COMPONENT

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THE INVESTIGATION OF ATTITUDE CHANGES OF ELEMENTARY PRESERVICE TEACHERS IN A COMPETENCY-BASED, FIELD-ORIENTED SCIENCE METHODS COURSE

Introduction

Since the teacher generally determines what is taught and how much the student participates in a classroom activity, the very nature of the student's learning experience is greatly affected by the teacher's attitudes and behaviors. In 1958, Todd identified teacher attitude as being a significant deterrent to effective teaching of science. Thomas and Thompson (1975) state that since Todd's investigation, "There is little to indicate that the attitudes of teachers, men or women, have received much revision." (Page 213)

In spite of the development of new science curricula over the past decade little has happened to change attitudes and allay the fear of elementary teachers toward teaching science. Butzow stated in 1973 that,

> Many school personnel express a dislike for science that is rooted deeply in failure to learn science when they were elementary, secondary, or college students. This fear stems from the methodology of instruction by which these people were taught. (Page 21)

Since it is assumed that attitudes are not innate, then positive attitudes toward teaching science can be learned. Therefore, courses including methodologies of instruction conducive to changing attitudes should be developed and investigated.

One such course was developed around preservice teachers' needs identified through questionnaires and feedback sessions. The preservice

teachers indicated that a science methods course successful in teaching them to teach science should include:

1. Being taught on campus as they will be expected to teach;
2. Participating in field experiences which provide practice teaching entire classes;
3. Being informed of behaviors expected of them in teaching science to children.

The attitude changes which occurred in preservice teachers participating in this elementary science methods course were investigated.

Purpose of the Study

The purpose of this study was to determine attitude changes of elementary preservice teachers toward teaching science as these students progressed through a competency-based, field-oriented science methods course.

Two questions were asked:

1. Do attitudes of preservice elementary teachers toward teaching science change in a positive direction during and following a competency-based, field-oriented science methods course?
2. If attitudes of preservice elementary teachers change in a positive direction during and following a competency-based, field-oriented science methods course, will these attitudes remain positive over an extended period of time; and if so, will these teachers indicate that they are teaching science?

Procedure

Sample

The subjects of this study were 36 preservice teachers randomly selected from 160 preservice teachers in four sections of an elementary science methods course at the University of Houston.

Instrumentation

The Semantic Differential, as established by Osgood, Suci, and Tannenbaum (1957), uses a bipolar set of adjectives to determine the perception an individual associates with a concept. Each protocol word or phrase is judged on a seven step scale in relation to each of twelve pairs of descriptive adjectives. The protocol phrases used in this study were:

1. Science Courses in High School
2. Science as Remembered in Elementary School
3. Science Education Methods Courses
4. Science in the News
5. Teaching Science to Children

Data Collection

The 36 randomly selected elementary preservice teachers were given the Semantic Differential (1) in the latter part of September, 1974 prior to the beginning of class activities on campus; (2) one month later at the end of class activities and prior to the beginning of field experi-

ences; and (3) following field experiences. In addition, one year later (November, 1975), all 160 preservice teachers were sent the Semantic Differential along with a questionnaire to be completed and returned by mail. It was expected that these preservice teachers had graduated and were teaching. 86 of the 160 responded. Social security numbers were matched and 23 of the original 36 had responded.

Data Analysis

A one-way analysis of variance was used to analyze (1) the total responses toward each protocol and (2) the total responses toward the three factors of each protocol: evaluation, potency and activity.

The scale, consisting of seven steps, between each of the twelve bipolar adjectives was assigned numerical values from one to seven, one indicating the most positive attitude.

The numbers in the tables indicate the total mean sums for all responses. A change from a higher number to a lower number indicates a change toward a positive attitude.

Results of the Study

Question #1:

1. Do attitudes of preservice elementary teachers change toward teaching science in a positive direction during and following a competency-based, field-oriented science methods course?

Responses indicated both positive and negative changes from September to October following one month of campus activities (Table 1). The negative trends were toward the protocols "Science in High School" and

TABLE 1

STUDENTS CHANGE IN ATTITUDE FROM SEPTEMBER TO OCTOBER

FOLLOWING CAMPUS EXPERIENCE

Total and Sub-Totals, EPA+

Protocol		Mean September Attitude N=36	Mean October Attitude N=36	Mean Attitude Change	Mean Probability Level
1. Science in High School	E	13.31	15.33	2.02	.02*
	P	15.47	15.53	.06	.92
	A	14.08	15.36	1.28	.14
	TOTAL	42.86	46.22	3.36	.09
2. Science as Remembered in Elementary School	E	14.11	15.28	1.17	.21
	P	17.67	17.03	-.64	.23
	A	16.58	16.89	.31	.74
	TOTAL	48.36	49.19	.83	.67
3. Science Methods Courses	E	12.33	8.58	-3.75	.00*
	P	15.28	13.86	-1.42	.01*
	A	14.39	10.64	-3.75	.00*
	TOTAL	42.00	33.08	-8.92	.00*
4. Science in the News	E	11.83	12.00	.17	.82
	P	15.00	16.14	1.14	.13
	A	13.67	14.03	.36	.65
	TOTAL	40.50	42.17	1.67	.35
5. Teaching Science to Children	E	10.00	10.33	.33	.65
	P	15.58	14.08	-1.50	.01*
	A	12.67	11.47	-1.20	.09
	TOTAL	38.25	35.89	-2.36	.14

+E (Evaluation)
P (Potency)
A (Activity)

*Level of Significance at .05 Level

"Science as Remembered in Elementary School." There were statistically significant changes in a positive direction toward "Science Methods Courses" for all three factors (evaluation, potency, activity) and toward "Teaching Science to Children" for one factor (potency) at the end of one month (Table 1). There were no changes in attitudes prior to the field experience (Table 2). Following field experiences, there were statistically significant changes in a positive direction toward "Science Methods Course" for all three factors and toward "Teaching Science to Children" for the factors, potency and activity (Table 3).

Question #2:

2. If attitudes of preservice elementary teachers change in a positive direction during and following a competency-based, field-oriented methods course: will these attitudes toward teaching science remain positive over an extended period of time; and if so, will there be an indication of science being taught?

The attitudes of the original set of preservice teachers (23 of 36) who are now teaching did not change significantly over a year's time (Table 4).

In addition to the attitude instrument, teachers were asked to respond to four survey questions.

1. I am teaching now. ☐ yes ☐ no

2. EED 334 (Science Methods) taught me to teach science to children. ☐ yes ☐ no

TABLE 2

STUDENTS CHANGE IN ATTITUDE FROM OCTOBER TO NOVEMBER

FOLLOWING FIELD EXPERIENCE

Total and Sub-Totals, EPA+

Protocol		Mean October Attitude N=36	Mean November Attitude N=36	Mean Attitude Change	Mean Probability Level
1. Science in High School	E	15.33	14.67	-.66	.48
	P	15.53	15.17	-.36	.52
	A	15.36	15.14	-.22	.80
	TOTAL	46.22	44.97	-1.25	.51
2. Science as Remembered in Elementary School	E	15.28	14.31	-.97	.35
	P	17.03	16.67	-.36	.60
	A	16.89	17.06	.17	.87
	TOTAL	49.19	48.03	-1.17	.62
3. Science Methods Course	E	8.58	8.81	.22	.75
	P	13.86	13.53	-.33	.54
	A	10.64	10.25	-.39	.59
	TOTAL	33.08	32.58	-.50	.75
4. Science in the News	E	12.00	11.69	-.31	.70
	P	16.14	15.25	-.89	.18
	A	14.03	14.42	.39	.63
	TOTAL	42.17	41.36	-.81	.29
5. Teaching Science to Children	E	10.33	9.03	-1.30	.08
	P	14.08	14.31	.22	.74
	A	11.47	10.67	-.81	.29
	TOTAL	35.89	34.00	-1.89	.27

+E (Evaluation)
P (Potency)
A (Activity)

*Level of Significance at .05 Level

TABLE 3

STUDENTS CHANGE IN ATTITUDE FROM SEPTEMBER TO NOVEMBER

FOLLOWING CAMPUS ACTIVITIES AND FIELD EXPERIENCES

Total and Sub-Totals, EPA+

Protocol		Mean September Attitude N=36	Mean November Attitude N=36	Mean Attitude Change	Mean Probability Level
1. Science in High School	E	13.31	14.67	1.36	.17
	P	15.47	15.17	-.31	.55
	A	14.08	15.14	1.06	.26
	TOTAL	42.86	44.97	2.11	.31
2. Science as Remembered in Elementary School	E	14.11	14.31	..20	.85
	P	17.67	16.67	-1.00	.14
	A	16.58	17.06	.47	.62
	TOTAL	48.36	48.03	-.33	.88
3. Science Methods Course	E	12.33	8.81	-3.53	.00*
	P	15.28	13.53	-1.75	.00*
	A	14.39	10.25	-4.14	.00*
	TOTAL	42.00	32.58	-9.42	.00*
4. Science in the News	E	11.83	11.69	-.14	.86
	P	15.00	15.25	.25	.73
	A	13.67	14.42	.75	.36
	TOTAL	40.50	41.36	.86	.65
5. Teaching Science to Children	E	10.00	9.03	-.97	.20
	P	15.58	14.31	-1.28	.04*
	A	12.67	10.67	-2.00	.01*
	TOTAL	38.25	34.00	-4.25	.01*

+E (Evaluation)
P (Potency)
A (Activity)

*Level of Significance at .05 Level

TABLE 4

STUDENTS CHANGE IN ATTITUDE

NOVEMBER, 1974 TO NOVEMBER, 1975

Total and Sub-Totals, EPA+

Protocol		Mean November 1974 Attitude N=23	Mean November 1975 Attitude N=23	Mean Attitude Change	Mean Probability Level
1. Science in High School	E	14.67	14.04	-.63	.41
	P	15.16	16.21	1.01	.16
	A	15.14	16.83	-.68	.14
	TOTAL	44.97	47.09	2.01	.62
2. Science as Remembered in Elementary School	E	14.31	16.17	1.86	.13
	P	16.67	17.70	1.03	.26
	A	17.06	19.17	2.11	.08
	TOTAL	48.03	53.04	5.01	.14
3. Science Methods Course	E	8.81	7.87	-.94	.26
	P	13.53	12.83	-.70	.29
	A	10.25	10.22	.03	.97
	TOTAL	32.58	30.91	-1.67	.35
4. Science in the News	E	11.69	12.30	.61	.49
	P	15.25	15.61	.36	.65
	A	14.42	14.26	-.16	.88
	TOTAL	41.36	42.17	.81	.72
5. Teaching Science to Children	E	9.03	8.09	-.94	.25
	P	14.31	12.70	-1.61	.06
	A	10.67	10.52	-.15	.86
	TOTAL	34.00	31.30	-2.70	.15

+E (Evaluation)
P (Potency)
A (Activity)

*Level of Significance at .05 Level

3. I am teaching science to my class. ☐ yes ☐ no

4. I need additional help to know how to teach science to children.

☐ yes ☐ no

The analysis of the respondents is presented in Table 5. Four of the 23 respondents indicated that they were not teaching. Eighteen responded that the methods course did teach them to teach science. (Eight respondents indicated they were not teaching science and needed additional help to teach science to children.)

Conclusions and Implications

The analysis of data from this study indicates that preservice teachers' attitudes toward teaching science were by participating in a specially designed course changed in a positive direction. In addition, these attitudes, once changed, remain fairly constant over a year's time. It should be noted, however, that 35% of those who responded after a year's lapse felt they needed additional help to teach science.

Following the science methods course, preservice teachers were asked to list the characteristics of the course which they liked best. The most often mentioned were: (1) the competencies to be mastered in the course were publicly stated; (2) the instructors modeled the behaviors the preservice teachers were expected to demonstrate; (3) campus activities were planned to assist preservice teachers in having success-

ful field experiences and, (4) instructors provided personalized feedback following field experiences.

Further research would be needed to determine whether a combination of all the characteristics of the course was responsible for changing attitudes toward teaching science or whether one or two might have been responsible.

TABLE 5

RESPONSES TO SURVEY

Questions	Responses N=23	
	Yes	No
1. I am teaching now.	19	4
2. EED 334 (Science Methods) taught me to teach science to children.	18	5
3. I am teaching science to my class.	15	8
4. I need additional help to know how to teach science.	8	15

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ATTITUDE CHANGES OF CLASSROOM TEACHERS COOPERATING WITH THE FIELD COMPONENT OF AN ELEMENTARY SCIENCE METHODS COURSE

Introduction

It is generally acknowledged that elementary teachers' attitudes toward science are less than positive (Thomasan, 1975). Inservice programs can improve attitudes toward science and science teaching and improved attitudes have been correlated with an increase in teaching activities (Piper, 1973). However, other than inservice programs, very little has been done to explore alternative ways to improve the classroom teacher's attitude toward science.

Purpose of the Study

The purpose of this study was to explore changes of teachers' attitudes toward teaching science by having them observe science activities being taught in their classrooms by preservice teachers.

The question asked was:

1. Do elementary classroom teachers' attitudes toward teaching science change in a positive direction following twelve activities being taught in their classrooms by elementary preservice teachers enrolled in a science methods course?

Procedure

Sample

The subjects of this study were the 13 classroom teachers who

cooperated with the 36 elementary science methods students who were the subjects of the first study.

Instrumentation

The Semantic Differential, as established by Osgood, Suci, and Tannenbaum (1957), uses a bipolar set of adjectives to determine the perception an individual associates with a concept. Each protocol word or phrase is judged on a seven step scale in relation to each of twelve pairs of descriptive adjectives. The protocol phrases used in this study were:

1. Science Courses in High School
2. Science as Remembered in Elementary School
3. Science Education Methods Courses
4. Science in the News
5. Teaching Science to Children

Data Collection

The 13 classroom teachers were given the Semantic Differential twice: (1) prior to a six-week period during which the methods students taught twelve activities in their classrooms and (2) following this six-week period.

Data Analysis

A one-way analysis of variance was used to analyze (1) the total responses toward each protocol and (2) the total responses toward the three factors of each protocol: evaluation, potency and activity.

The scale, consisting of seven steps, between each of the twelve bipolar adjectives was assigned numerical values from one to seven, one indicating the most positive attitude.

The numbers in the tables indicate the total mean sums for all responses. A change from a higher number to a lower number indicates a change toward a positive attitude.

Results of the Study

Question:

Do elementary classroom teachers' attitudes toward teaching science change in a positive direction following twelve activities being taught in their classrooms by elementary preservice teachers enrolled in a science methods course?

Responses indicated both positive and negative changes over the six-week period (Table 1). There were statistically significant changes in a negative direction toward "Science in High School" for the factor activity. There were statistically significant changes in a positive direction toward "Teaching Science to Children" for the factors, potency and activity.

TABLE 1

ATTITUDE CHANGES IN ELEMENTARY CLASSROOM TEACHERS
FOLLOWING ELEMENTARY SCIENCE METHODS STUDENTS
TEACHING IN CLASSROOM

		Total and Sub-Totals, EPA+			
		Mean September Attitude N=13	Mean November Attitude N-13	Mean Attitude Change	Mean Probability Level
1. Science in High School	E	11.85	10.92	.62	.62
	P	15.39	14.54	-1.46	.39
	A	15.69	12.08	.15	.02*
	TOTAL	42.92	37.53	-1.00	.17
2. Science as Remembered in Elementary School	E	12.61	13.23	-1.69	.74
	P	15.77	14.31	.46	.32
	A	14.01	13.92	-1.61	.92
	TOTAL	42.46	41.46	-2.85	.83
3. Science Methods Course	E	11.23	10.39	-1.61	.56
	P	15.61	14.23	-3.31	.21
	A	13.39	11.31	-3.61	.16
	TOTAL	40.23	35.92	-8.54	.19
4. Science in the News	E	14.92	13.23	-.85	.35
	P	15.85	16.31	1.38	.70
	A	16.85	15.23	-2.08	.31
	TOTAL	47.61	44.77	-4.31	.51
5. Teaching Science to Children	E	14.69	13.08	-.92	.47
	P	17.54	14.23	-.85	.02*
	A	16.85	12.23	-3.61	.05*
	TOTAL	49.08	40.54	-5.39	.10

+E (Evaluation)
P (Potency)
A (Activity)

*Level of Significance at .05 Level

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